Custom Protocol Creation Guide – OCTO MK2

A convenient and time-saving DIY solution for user to control pixel fixtures (two criteria apply).

Introduction

OCTO MK2 features more than 20 pixel output protocols in the device – full list available on ENTTEC website. In the event of missing protocol, this new feature in OCTO MK2 would allow user to create custom protocol for desired pixel fixture anytime (*two key criteria apply)* without having to submit support request for new firmware.

Within this document is setup instruction for custom pixel output protocols, alongside guide on criteria verification.

The creation requires user to first select compatible pixel protocol offered in dropdown list *(as per two key criteria),* follow by adjustment of pixel fixture's data voltage timing *(according to manufacturer datasheet)* on OCTO MK2's web interface where applicable.

To start, DATASHEET of desired pixel fixture is required to verify key criteria for eligibility and info for creation. Reach out to dealer or fixture manufacturer for Datasheet.

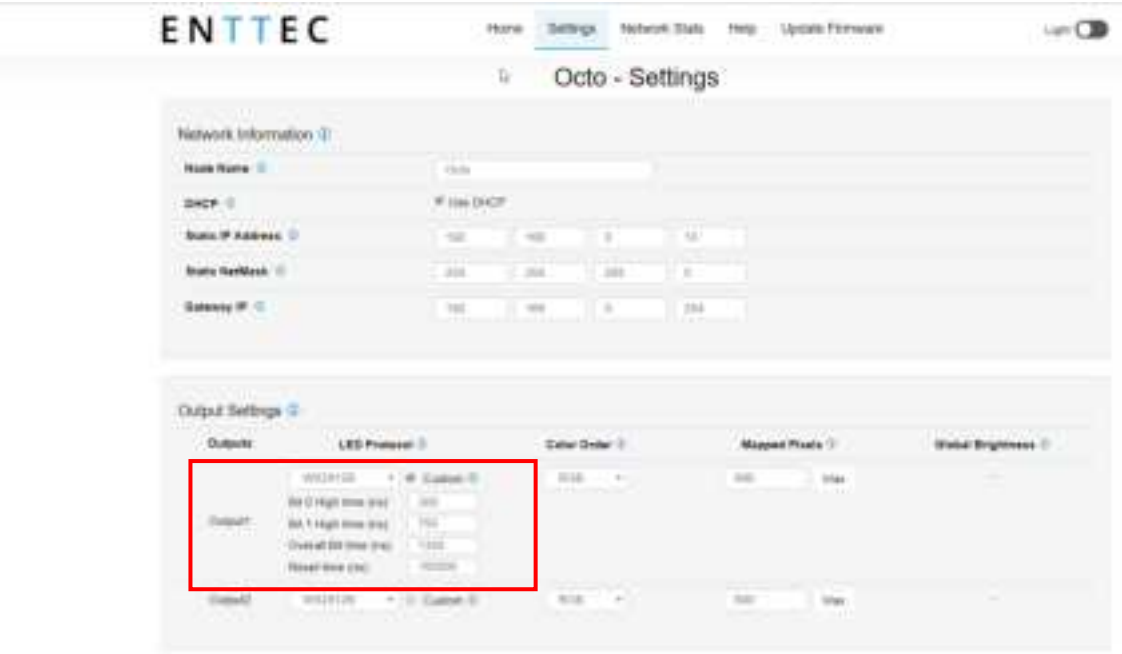

Figure 1 - OCTO MK2 custom protocol settings from web interface.

Figure 1 shows settings page on OCTO MK2's web interface; the feature allows set up of custom protocol on output port 1 & 2 separately.

Two key criteria for custom pixel protocol eligibility

For custom output protocol creation, the desired pixel fixture must meet two key criteria:

A. ***Data structure***
B. ***Data Transmission Method***.

A. Data Structure

This is how pixel data are formatted. Data structure consists of 2 sub-compositions.

1. Data bit: 8bit or 16bit
2. Channel number: 3 channels - RGB or 4 channels – RGBW *(colour order doesn't matter).*

OCTO MK2 currently supports 4 types of data structure:

1. 8bit x 3 channels (RGB) = 24bit data
2. 8bit x 4 channels (RGBW) = 32bit data
3. 16bit x 3 channels (RGB) = 48bit data
4. 16bit x 4 channels (RGBW) = 64bit data

Datasheet - Data Structure info example:

1. WB2812B's datasheet (24-bit):

Figure 2 indicates composition of 24bit data with G7-G0, R7-B0, and B7-B0. As a result, the Data Structure of WB2812B is made of 8bit of G(green), B(Blue) and R(Red) each = 8bit x 3 channels (GRB) = 24-bit.

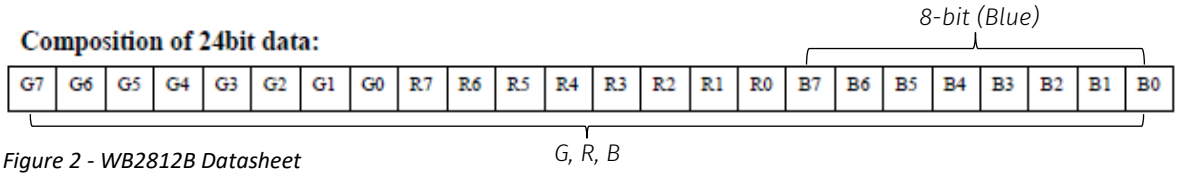

Figure 2 - WB2812B Datasheet

2. TM1814's datasheet (32-bit):

Figure 3 indicates composition of 32bit: W7-W0, R7-R0, G7-G0 and B7-B0. As a result, the Data Structure of TM1814 is made of 8bit of W(White), R(Red), G(Green) and B(Blue) each = 8bit x 4 channels (WRGB) = 32-bit.

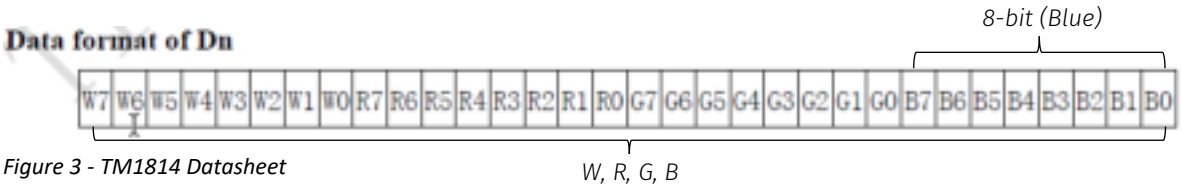

Figure 3 - TM1814 Datasheet

3. UCS8903's datasheet (48-bit):

Figure 4 indicates composition of 48bit: R15-R0, G15-G0 and B15-B0. As a result, the Data Structure of UCS8903 is made of 16bit of R(Red), G(Green) and B(Blue) each = 16bit x 3 channels (RGB) = 48-bit.

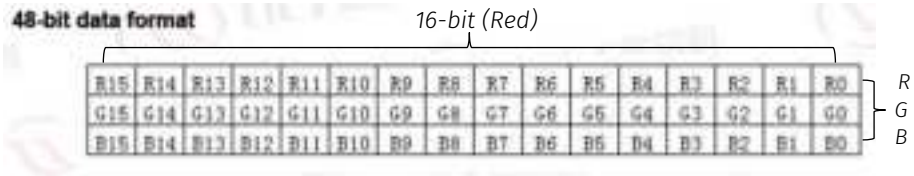

Figure 4 - UCS8903 Datasheet

4. UCS8904B's datasheet (64-bit):

In the event when there is lack of pictorial depiction of Data Structure in Datasheet, product description would indicate information to help with structure verification, such as "4 channels", which means RGBW. Other available text info such as "65536 levels of true grey" would indicate numerical formula equivalent to 16^4 - which means 16bit x 16bit x 16bit x 16bit to reach the conclusion of 16bit x 4 channels (RGBW) = 64-bits.

B. Data Transmission Method (also known as data cascade method)

This is how data are transmitted, and there are 2 main categories.

OCTO MK2 currently supports both category:

1. No additional bits: D1-D2-D3...Dn
2. Additional bits C1 & C2 (64bit): C1-C2-D1-D2-D3...Dn

Datasheet – Data Transmission info Example:

1. WB2812B's datasheet (D1-D2-D3...Dn):

Left side of **Figure 5** (adapted from datasheet) indicate data transmission by D1-D2-D3-D4 between Pixel; Right side shows each D1, D2, D3 are transmitted with data batch of 24bit (8bit x 3 channels) without additional bits on start and end of data. Hence, WB2812B falls in our first category D1-D2-D3...Dn.

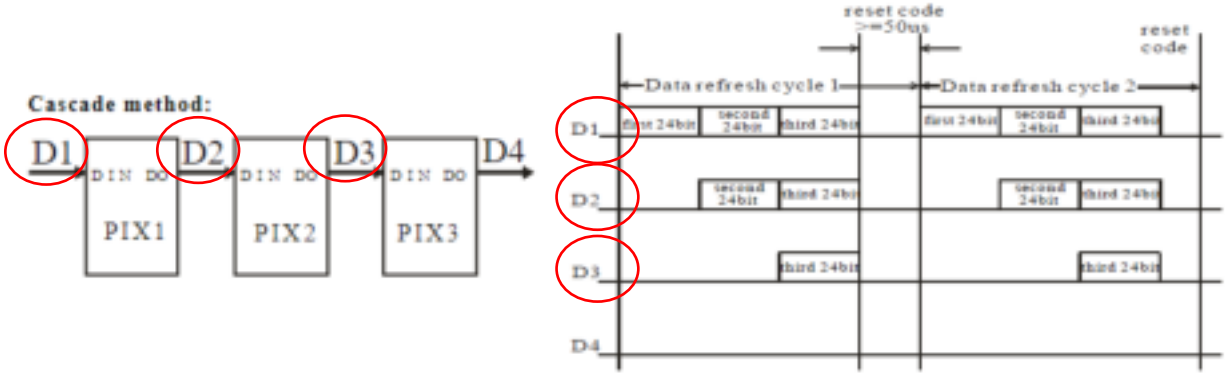

Figure 5 - Data Transmission Method in WB2812B Datasheet

2. TM1814's datasheet (C1-C2-D1-D2-D3...Dn):

Left side of **Figure 6** (adapted from datasheet) indicates 'Data receiving and forwarding' with S1-S2-S3-S4 between pixel (chip); Right side shows how S1, S2, S3 are transmitted with extra C1-C2 in the front of data batch. Hence, TM1814 falls in second category C1-C2-D1-D2-D3...Dn.

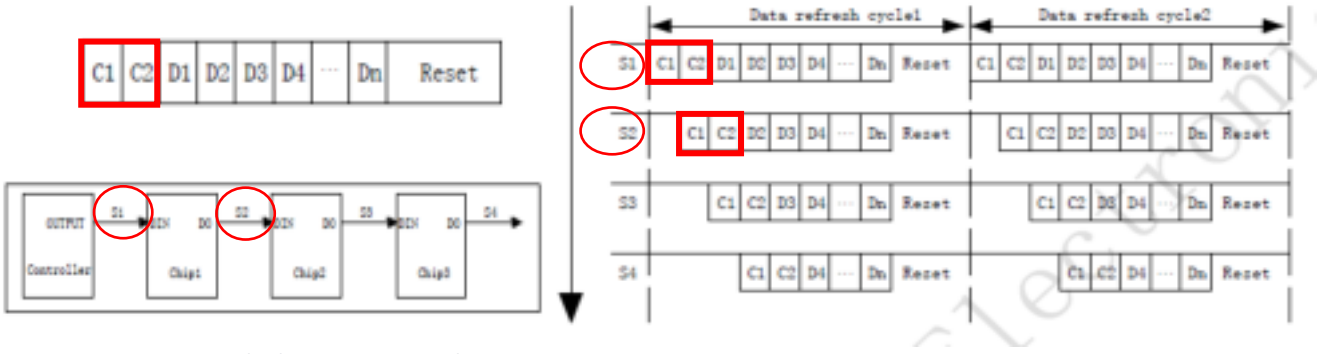

Figure 6 - Data Transmission Method in TM1814 Datasheet

Creation Steps

Once desired pixel fixture meets both key criteria in previous section, it is eligible for custom protocol creation. To start, following are required:

1. Device such as computer or smart phone with Internet browser app (such as Google Chrome) that is on same local network to OCTO MK2.
2. OCTO MK2 IP address – this can be DHCP or static IP address depending on your network settings. Discoverable with ENTTEC EMU app.
3. Datasheet of desired pixel fixture.

Step 1: Select an existing Pixel Protocol that matches desired pixel fixture

Pick from OCTO MK2 output protocol list for a protocol that shares the same data structure and transmission method with desired pixel fixture.

OCTO MK2 pixel protocols list can be categorised into 3 groups:

1. WS2812B: This is the suggested protocol to select if your pixel fixture's data structure is 8bit x RGB/RGBW and the transmission method has no additional bit D1-D2-D3...Dn. You can also choose the following OCTO MK2 pre-listed pixel protocols in this category: WS2811, WS2812, WS2813, WS2818, UCS1903, UCS2903, UCS2904, UCS8903 (8bit), UCS8904 (8bit) APA104, SK6812, TM1804 and TM1812, SPXL (8bit).
2. TM1814: This is the suggested protocol to select if your pixel fixture's data structure is 8bit x RGBW and the transmission method is C1-C2-D1-D2-D3...Dn with additional 64bit constant current value in the front.
3. UCS8903 (16bit): This is the suggested protocol to select if your pixel fixture's data structure is 16bit x RGB/RGBW and the transmission method has no additional bit D1-D2-D3...Dn. You can also choose the following OCTO MK2 pre-listed pixel protocols in this category: UCS8904 (16bit) and SPXL (16bit).

*APA102 and 9PDOT are not compatible with Custom Protocol at the current firmware.

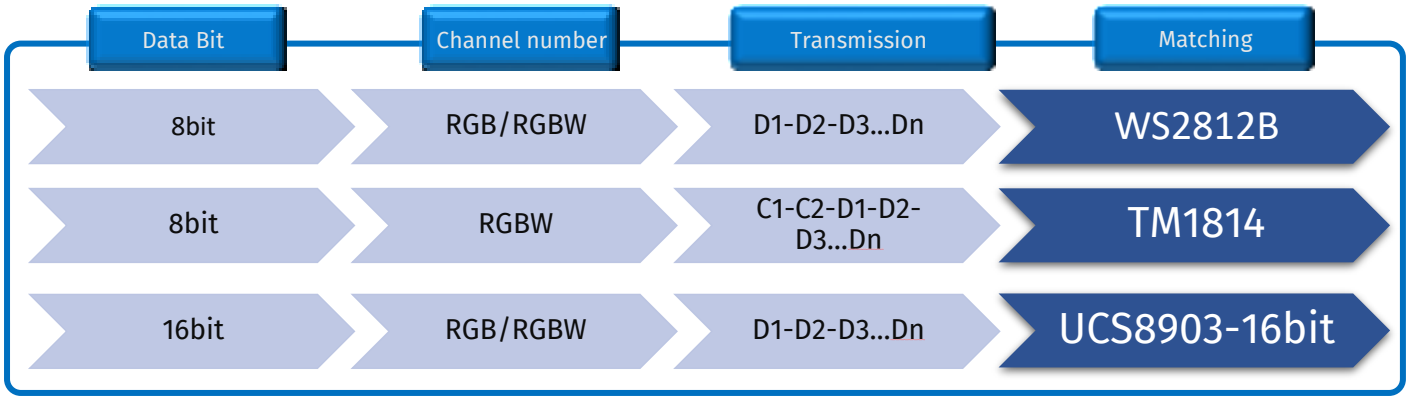

Figure 7 - Flow chart on How to select the protocol that matches your pixel fixture.

Step 2: Navigate to settings page on web interface

i. Access OCTO MK2 web interface

ENTEC recommend Google Chrome as web browser to access OCTO MK2 web interface.
After entering IP address of OCTO MK2, user will land on Home page of OCTO MK2.
Free ENTTEC app, EMU can be used to retrieve OCTO MK2 IP address. See ENTTEC website to download app.

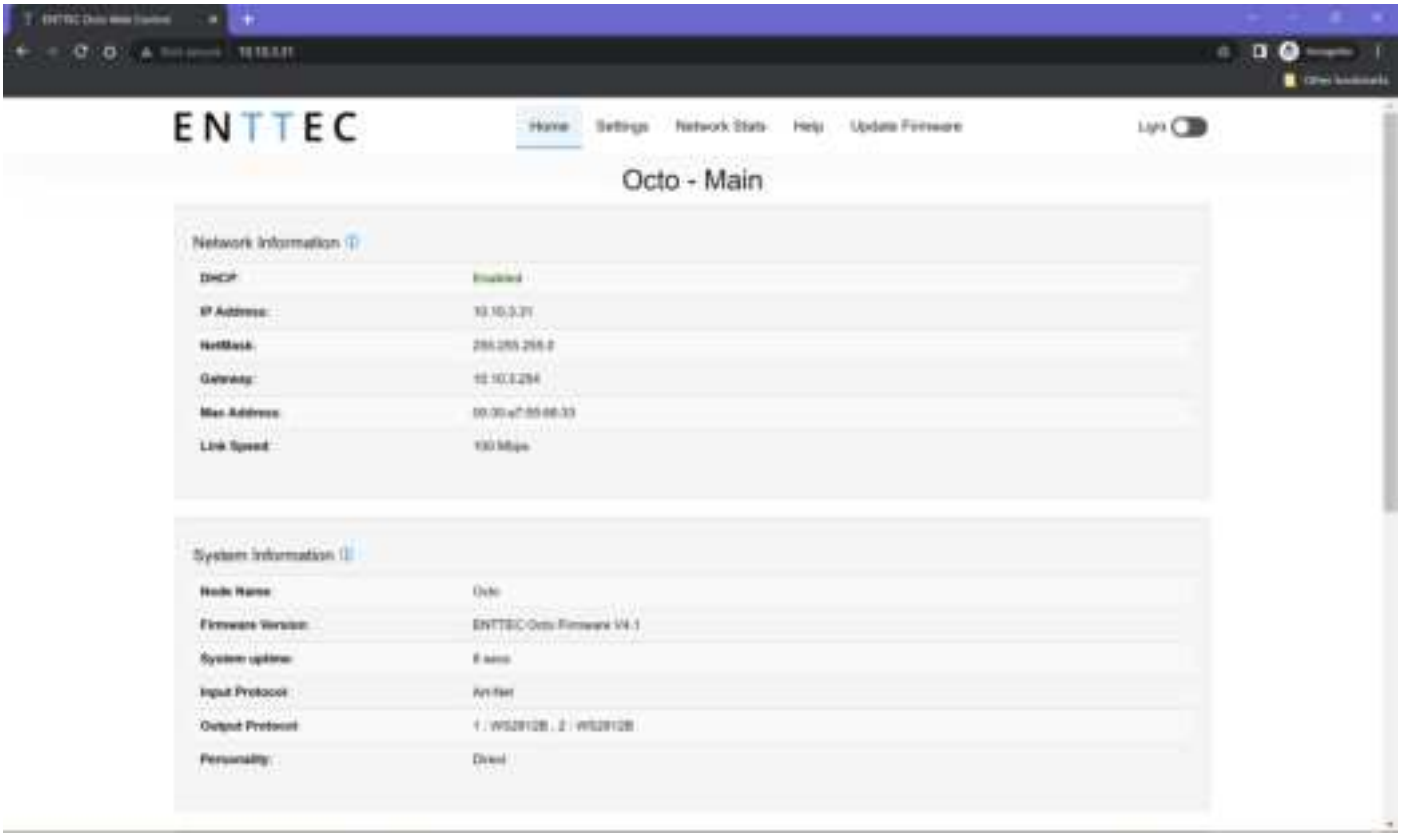

Figure 8 - OCTO MK2 Home Page

OCTO homepage in Figure 8 indicates IP address 10.10.3.31, which was assigned by DHCP server. For out of box OCTO that is connected directly to a computer (no DHCP server), OCTO MK2 default IP address will be 192.168.0.10.
See OCTO MK2 User Manual 'Networking' section for more info.

ii. Navigate to Settings page – Output setting

With desired pixel fixture connected to Output 1, *pick pixel protocol from dropdown list that shares same data structure and transmission method*. See step 1 for details.

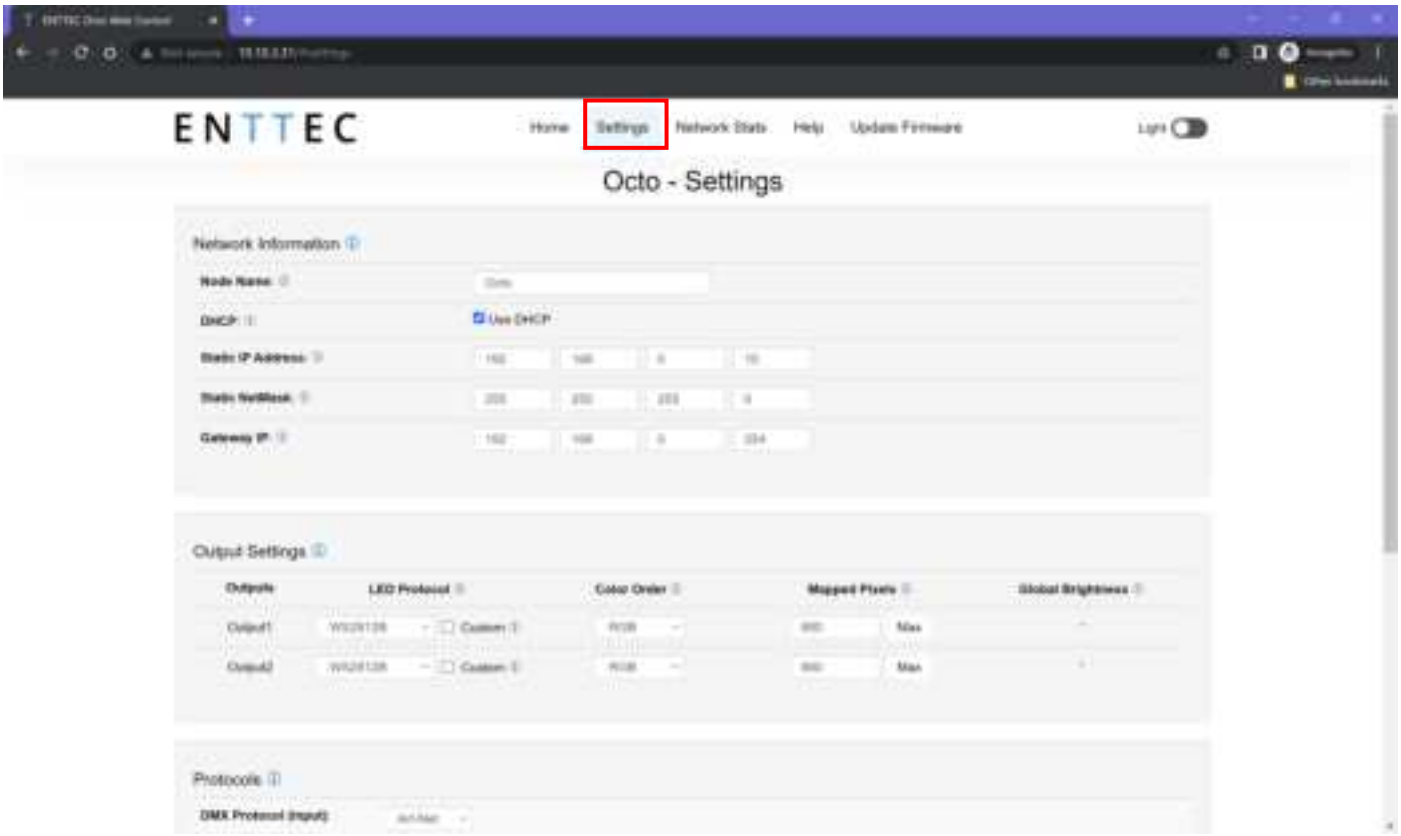

Figure 9 - OCTO MK2 Settings Page

iii. Enable Custom protocol

Enable 'Custom' tickbox to access data voltage timing setup.
Untick to disable custom protocol.

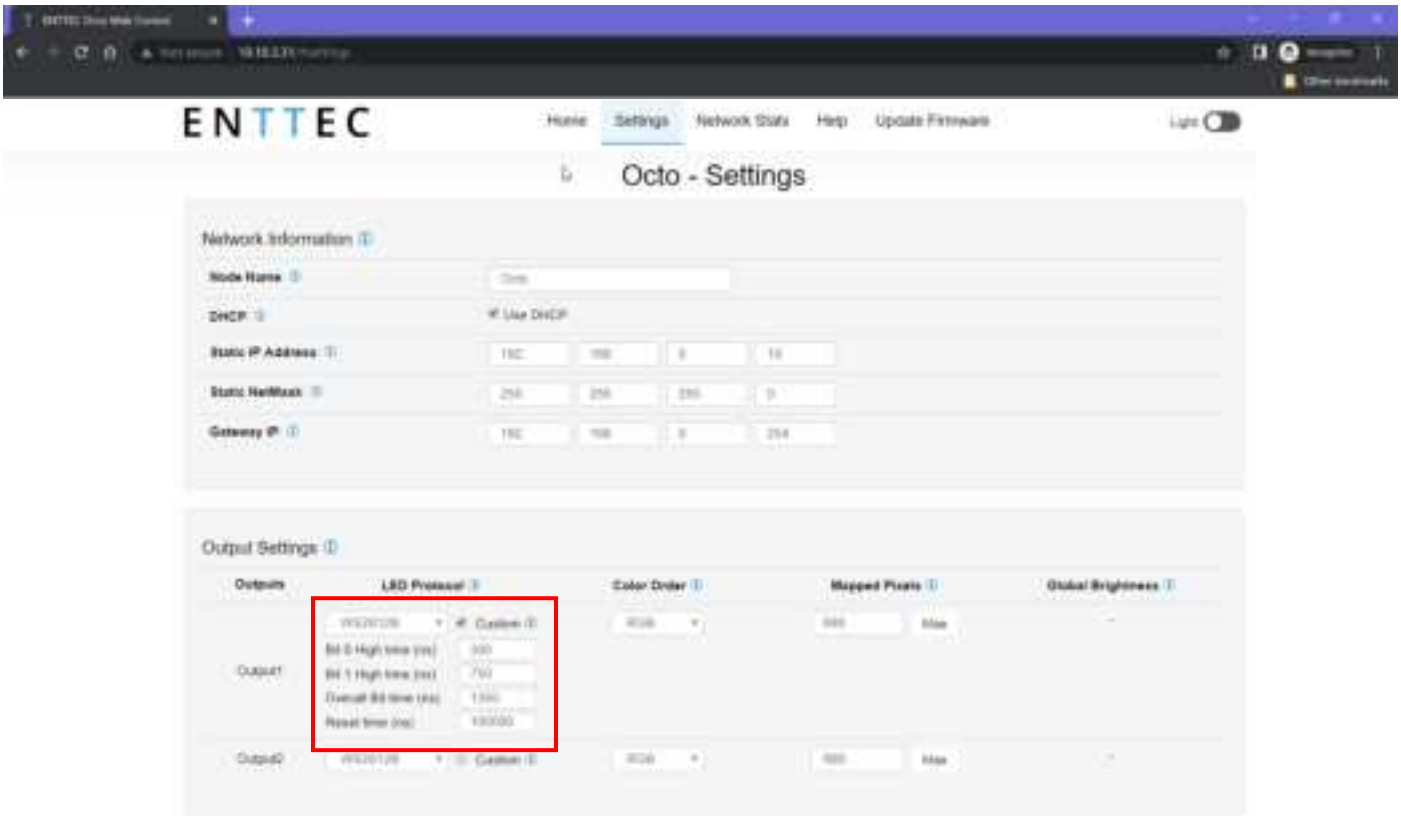

Figure 10 - OCTO MK2 Custom field after enabling 'Custom' tick box

Step 3: Insert Data voltage timing

OCTO MK2 requires 4 inputs to complete Data voltage timing modification:

1. **Bit 0 High Time (T0H):** The voltage high time required to indicate code 0.
2. **Bit 1 High Time (T1H):** The voltage high time required to indicate code 1.
3. **Overall Bit Time:** The total voltage time for a single bit.
   Lower limit = T0H+T0L
   Upper limit = T1H+T1L
4. **Reset Time:** The total voltage low time required to reset the data transmission between each data batch.

Datasheet – Data voltage timing info Example:

WB2818B's datasheet

Locate '**Sequence Time**' table (Figure 1) in datasheet for voltage timing range to insert on OCTO MK2 web interface (Figure 12).

Sequence Time

T0H	0-code, High-level time	220ns~380ns
T1H	1-code, High-level time	580ns~1μs
T0L	0-code, Low-level time	580ns~1μs
T1L	1-code, Low-level time	580ns~1μs
RES	Frame unit, Low-level time	> 280μs

Figure 11 - Voltage Timing from WB2818B Datasheet

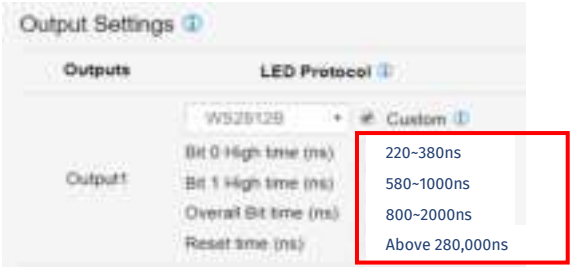

Figure 12 - Datasheet information interpreted into OCTO MK2's custom field

IMPORTANT

- ENTTEC recommend taking median value of the range for start.
- User will have to SAVE settings for modified value to take effect.
- Fine adjustment of value required, follow by actual output test to optimise custom protocol for pixel fixture control.
- ENTTEC recommend a trial run on actual setup before finalising custom protocol setup
- Typical issue of incorrect setup includes and not limited to failure to light up, output flickering.

CONCLUSION

That brings us to the end of this guide. By following these steps, you can create a custom pixel protocol that is not in our drop-down list. This guide gives you a technical knowledge about the pixel protocols and the run down on how to set this up in the OCTO MK2.

By following these steps, you can create custom protocols anytime without waiting on technical support. However, if you still have questions and have difficulty finding right information, please contact our friendly support team to the local offices.

We hope you found this guide useful!